UNIVERSITI TEKNOLOGI MARA

THE DOCTORAL RESEARCH ABSTRACTS

Volume: 7, Issue 7 May 2015

SEVENTH ISSUE

INSTITUTE of GRADUATE STUDIES

Leading You To Greater Heights, Degree by Degree

IGS Biannual Publication

19

Name :
Siti Shawalliah Idris

Title :
Production of Solid Fuel From Oil Palm Biomass Via Microwave Irradiation Pyrolysis Technique for Co-Combustion with Coal

Supervisor :
Associate Prof. Dr. Norazah Abd Rahman (MS)
Prof. Dr. Khudzir Ismail (CS)

Co-utilisation of coal and biomass deem to be one of the alternatives to reduce climate changes due to global warming. Despite rapid development in this area, no work has been reported on co-firing of coal-biomass char blend derived from oil palm waste. Nevertheless, much research has shown that, lack of synergistic effect was observed during the combustion of the two fuels, resulting in little improvement in combustion efficiency/ emission. Co-firing of coal with biomass char produced from microwave irradiation pyrolysis is undoubtedly a new area and will therefore contribute to new knowledge and novelty in this field. An investigation of co-utilisation empty fruit bunch (EFB), palm mesocarp fibre (PMF) and palm kernel shell (PKS) with sub-bituminous Mukah Balingian coal and six different blends were carried out via thermogravimetric analyser during pyrolysis and combustion at dynamic conditions in four heating rates. The behaviour of pyrolysis of oil palm biomass using microwave irradiation technique was carried out by exposing the samples at different parameter i.e. power level, exposure time and mass of samples where the best operating conditions was established using Response Surface Method (RSM). Resulting char produced from the optimum conditions were used for the co-combustion characteristics of coal: biomass char blends. Thermal profiles of the coal/oil palm biomass blends appear to correlate with percentage of biomass added in the blends, thus, suggesting lack of interaction between them during pyrolysis and combustion. In the microwave assisted pyrolysis experiment, the power level has least important influence to the solid char yield of EFB and PMF. No significant impact on the solid char yield of PMF beyond 10 minutes of exposure. Maximum mass input for EFB, PMF and PKS is 40 g, 50 g and 25 g, respectively. Calorific values of the solid char produced were comparable to a low rank coal (>22 MJ/kg). From the RSM analysis, the best conditions for obtaining high char yield and high calorific values have been determined with power of 300W, exposure time in the range of 16.7 – 32 min., and initial sample mass in the range of 20 – 40.4 g. Upon combustion of biomass char from microwave and tube furnace pyrolysis depicts one evolution profile that was similar to that of MB coal. When blending MB coal with the biomass chars produced from both pyrolysis techniques, synergistic effect was observed in all blends except 80 wt% of EFBMW:MB coal blend ; PMFMW:MB coal blend (40 – 60 wt%); and PKSMW:MB coal blend (20, 50 and 60 wt%). In comparison to char produced from tube furnace and coal blends, PMF char has not shown any synergistic effect, while 20, 40 and 60 wt% of PKS blends and all blends except 20 wt% EFB showed synergistic effect. Overall, the current study had shown for the first time that the pyrolytic char derived from oil palm biomass materials using microwave pyrolysis technique could be sustainably utilised as fuel to be co-firing with MB coal.